LOCAL ACCOUNTS OF THE AURORA OF MARCH 8, 1918, BY LATITUDE BELTS.

The reported observations have been grouped by latitude belts of 2½° each, for, as would be expected, the display had some uniformity within each latitude belt. Comparisons of accounts from nearby stations in different latitudes are also interesting. Much of the information found in the reports collected from the localities from which descriptions have been received has been included in the discussions by latitude belts, so those notes mentioning the fact of the occurrence of the aurora and perhaps a few general features of the display have been omitted, while all the extensive detailed descriptions, and a few others, in all, have been quoted below.

52½ to 50° N. lat.—The following extract is from the account by Mr. F. W. Venables, Observer at South-end-on-Sea. It is exceptional for the aurora to produce such striking effects in the south of England.

Just after one o'clock I went out into the street to have a look round and saw a neighbour, who said he had been watching a red glow in the sky as though there was a fire; the direction he pointed out to me was NE.

As we stood talking a strange light seemed to appear as though the moon was rising; we commented on this and said it could not be the case as the moon did not rise till after 3. We then noticed it appeared brighter across the fields looking due N.: the sky at the time was perfectly clear of clouds; the colour of light appeared a light greenish tint on the horizon, which then changed into a turquoise a trifle higher in the sky, then into a pink tint and lastly at the highest point it was a rosy hue; the colours were then magnificent from the horizon to about one-third up the sky, and remained so for nearly ten minutes, from 1:20 to 1:30; the position of light was from N. to NNW.—*Met. Off. Cir., 22, Mar. 26, 1918, p. 3.*

50° to 47½° N. lat.—In this northern belt, for which observations from four places are at hand, the display at its greatest extent covered practically the entire sky. There was, naturally, no well-defined arch, and the aurora seemed to have little unity as a display, except perhaps for the unusual amount of red coloring.

Devils Lake, N. Dak. (90th meridian time), *March 7.*—The auroral display on the 7th was brilliant and magnificent and prevailed from 7:45 p. m. to 11 p. m. There was no well-defined arch. Many streamers of light and patches of light were prevalent in all regions of the sky, being especially prominent in the northeast and northwest sectors. The beauty of this display lay in its peculiar colors, of which the reddish tints were the most prominent. It was like the reflection in the sky of numerous distant conflagrations.

Williston, N. Dak. (90th meridian time), *March 7.*—An aurora was observed at 9:40 p. m., which extended in azimuth from 125° to 270°, and gradually extended to 300°. When first observed streamers which were of any ashy color reached almost to the zenith, but by 10:05 p. m. had moved southward, passing through the constellations of "Orion" and "Taurus"; about 10:10 p. m. the streamers had increased in density, at times resembling cirrus clouds; from 10:15 to 10:30 p. m. the streamers along the zenith for about 25° were tinted a light pink, which changed gradually to a fairly bright rose color; after 10:30 p. m. the streamers began to disappear, and by 10:45 p. m. the aurora was no longer visible.

Port Angeles, Wash. (120th meridian time), March 7.—Aurora observed on the night of the 7th, fairly bright, no streamers, only a glow.

47½° to 45° N. lat.—The nine reporting stations in this belt indicate that here also the aurora had a very indefinite form. The whole sky, except for less than 30° above the southern horizon was covered by the display. At a few places the principal display was in the south. The light was described as brilliant; and reds, white, greens, and yellows were the predominating colors. The tremulous motion visible in intense displays was mentioned in one report. In upper Michigan, at least, wire communication was rendered difficult. Where observed late, the display prevailed throughout the greater portion of the night.

Alpena, Mich. (90th meridian time), *March 7.*—The auroral display of the 7th was first observed at 7:10 p. m. as a diffused glow of straw-colored light in the southern sky. At this time the clouds were dissipating rapidly and soon revealed the fact that the entire heavens were brilliantly illuminated with a steady glow. Beyond [?] this glow a band of rose-colored light extended from east to west through the zenith. This band slowly faded overhead and broadened in the eastern and western skies. Later the straw-colored glow broke up into streamers and fiber-like clouds with the lines converging at a point slightly south of the zenith, forming a dome-like structure. At this time the luminous beams assumed a tremulous motion, producing a magnificent effect in front [?] of the rose-colored background. The whole display was characterized by the fact that it covered the whole heavens, starting close to the horizon. It disappeared at 11:15 p. m.

Escanaba, Mich. (90th meridian time), *March 7.*—An aurora was observed on this date from 6:45 p. m. until 11 p. m. The aurora consisted of two well-defined arches, the largest one extending from about 100° to 360° in azimuth, with an altitude of 45°. The second and subordinate arch had dimensions of about 120° to 200° in azimuth, with its arch of 20° in altitude. In appearance and general composition this aurora was the most beautiful of any ever observed at this station, surpassing that of August, 1916. As the phenomenon gradually increased in magnitude, bright streamers were seen to be concentrated at the zenith. These streamers were observed to be of bright yellowish light. After a short interval the scene and color changed to the eastward, where the streamers converged and outlined a well-defined circle resembling a halo of great proportions. The outlines of this circle gradually faded away and again the scene changed. The streamers turned to a pale alto-stratus cloud-like form, and, intermingled in this, appeared luminous bright red, fiery lights. Then greenish colors appeared and mingled with this red, the whole moving in a straight path from northwest to southeast. As the masses moved across the sky, they seemed to be attracted to the zenith, presenting the appearance of a huge parasol and covering the zenith for a large area around. The aurora prevailed throughout the greater portion of the night.

Houghton, Mich. (90th meridian time), *March 7.*—A brilliant aurora was observed on the 7th from 9 p. m. to midnight. It consisted of rapidly changing and many colored luminous patches, streamers, and flashes of light, at times being most brilliant in the south. Telegraph and telephone communication was rendered very difficult most of the night.

Sault Ste. Marie (90th meridian time), *March 7–8.*—An aurora of great brilliancy and unusual color and formation was visible from 9 p. m. to 11:30 p. m. on the 7th. It formed a complete circle, at no point approaching the horizon nearer than 35°. From 60° to 110° streamers started about 60° above the horizon. The predominating colors were white and green, with occasional patches of red, which varied from light to very dark. The red patches appeared on all sides, except north, shifting from point to point, appearing at times pale and gradually becoming very dark, later fading and almost disappearing. At 9:40 p. m. red was the predominating color directly overhead, with very dark patches on the easterly and westerly quadrants and lighter on the southern, with greenish white streamers between and faintly discernible through [?] them.

Duluth, Minn. (90th. meridian time), *March 7.*—The aurora on the 7th was unusually brilliant. It was first observed at 8:15 p. m. and consisted of innumerable shafts of dazzling white, areas of pink and light to dark green color in rapid and rather bewildering sequence. The display continued with varying brilliancy until about 11 p. m. after which it was confined to widely scattered sections of the sky. At 9:30 p. m. the display centered at the zenith with pink and white shafts radiating therefrom in all directions, most of these shafts reaching nearly to the horizon.

**Northfield, Minn.*—The display was on when twilight darkened and was still active at 10:45 when our watch upon it ceased. A great green arch extended from the western horizon at azimuth 100° to the eastern horizon at azimuth 280°, passing over the constellation Orion in its course. The arch was wide enough to more than cover Orion. It drifted slowly southward until the lower edge covered Sirius. A narrower arch of the same color occasionally formed and disappeared about midway between the great arch and the southern horizon. Above the great arch was another arch of changeable color, red, yellow, and greenish white, composed of nearly vertical streamers, converging by perspective toward a point 5° to 10° south of the zenith. This arch was very bright red, especially toward the west in azimuth 105°, where it persisted during nearly the whole of the hour from 7:15 to 8:15, after which clouds intervened for a time. During part of the time this arch passed over the Pleiades and Castor and Pollux. Toward the north the auroral display was less brilliant, but there was a low green arch and many comparatively narrow streamers of red and yellowish color converging toward the zenith.

At 9 p. m., when the clouds partially cleared away, the red display had ceased and the green was less active, although it covered a large part of the sky. About 9:35 the red display again became active, but was mostly in the northern half of the sky. The great green arch in the southern sky broke up and almost completely vanished. Later the whole northern half of the sky was filled with streamers, mostly green, converging toward a point 10° south of the zenith.

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A 60°-prism telescope was turned upon the bright green arch and showed the auroral line as very strong, with four fainter lines almost equidistant from each other, the fourth being near the position of the F hydrogen line. The line at E was invisible or exceedingly faint. When the spectroscope was turned on a very bright red streamer one line could be seen in the red, not far from the C line of hydrogen. My impression was that this line was farther than C from the aurora line, but I had no means of measurement at hand. At times I thought I glimpsed a line in the yellow also, but I could not be sure of this.

As such auroral displays are usually associated with extraordinary activity in the sunspots, we took advantage of the next clear day to examine the sun's surface. On March 11, the first opportunity after March 7, a large group of spots was noticed near the central meridian of the sun on the northern hemisphere. The group was approximately 100,000 miles long and the chief spot nearly 20,000 miles in diameter, showing evidences of violent internal motions.—*H. C. Wilson.*

Bismarck, N. Dak. (90th meridian time), *March 7.*—An unusual auroral display in the southern sky was observed from 8:10 p. m. to 9 p. m. During this time there was a bank of dense clouds extending along the southern horizon to an altitude of about 15°. Above this bank of clouds was an arch of auroral light extending to an altitude of about 45°. The extremities of the arch were not clearly defined on account of the presence of the clouds. Also a band of irregular width, from 1 to 5°, extended from azimuth 112° across the sky to azimuth 292°. At times streamers would radiate from the middle point of this band, about 5° south of the zenith, occasionally in all directions, but mostly in arcs of 15 to 30° adjacent to the band. The colors of the streamers and band varied from white to pink. There was no indication of auroral light in the northern sky at this time, but a northern aurora was reported as seen between 10 and 11 p. m. the same evening.

Helena, Mont. (105th meridian time), *March 7.*—An unusually brilliant aurora was observed on the 7th. It was first observed at 7:50 p. m. and continued till 11 p. m. when no further attempt was made to observe it. The arc was indistinct and the exact position could not be determined on account of cirrus clouds that covered the northern half of the sky. The light was a pale green and very bright and the northern sky looked as if there was a great fire reflected from some distant point and the sky was especially bright in the northwest, which was probably due to a less amount of clouds in that section. The light appeared to be steady and the usual pulsations were not observed.

45° to 42½° N. lat.—The 33 reports from this latitude belt indicate that the aurora was most brilliant here. Some observers described the lights as equal to two-thirds to fully as bright as full moonlight. All the sky except for a small dark segment in the south was covered by the display. Reds were mentioned at all stations, greens at most, whites and yellows at a great many, purples and blues at a few, and even the colors of the rainbow at one. Flashing, pulsating, or quivering streamers were observed everywhere, and at some points the curtain-like waves characteristic of intense auroral arches seen at a high angle. The display lasted from dusk till several hours after midnight. Telegraphic communication was reported as hindered.

Burlington, Vt. (75th meridian time), *March 7–8.*—Aurora was first observed at 8 p. m., in the form of streamers of red, green, and yellow, changing color frequently, azimuth 90° to 280°, altitude 90°. At 10:30 p. m. bright auroral corona had formed. At 11:30 p. m. the corona began fading out. The display ended during the night. It was unusually brilliant.

Buffalo, N. Y. (75th meridian time), *March 7.*—On Thursday, the 7th, an aurora was observed at 7:45 p. m. A red arch extended upward from about 135° of azimuth to about 70° in altitude and curved back to the horizon at about 225° of azimuth. White streamers extended from the north point of the horizon toward the zenith, reaching up to the red arch, and green and blue streamers from the north point to the red arch westerly from the zenith. By 8:30 p. m. the coloring had disappeared and the white streamers and band had become very faint. At 9 p. m. the aurora was no longer visible.

Canton, N. Y. (75th meridian time), *March 7.*—Brilliant display of aurora from 7 p. m. to 11:30 p. m. Entire sky covered at times with diffused light of more than ordinary brilliancy, making light at times equal to two-thirds full moon. A variety of colors ranging from green to purple and carmine made an unusual sight. Pronounced arch in the south 9 to 10:20 p. m., with streamers reaching exactly to the zenith from the arch. Very dark inside the arch.

Oswego, N. Y. (75th meridian time), *March 7.*—An auroral light was visible at 7:30 p. m. It consisted of an arch of about 15° altitude extending from northwest to nearly east, and there were several scattered beams of light of a greenish tint. At 8:10 p. m. greenish beams of light extended from the horizon to the zenith, and from west to east. The display was greatly interfered with by clouds which were moving rapidly from the west, and at 8:13 p. m. they shut out the light entirely. At 10 p. m. the aurora was again visible in the south and west. In the south it was a diffused white light extending nearly to the zenith, and from west to east. In the west there were a few streamers. Up to this hour there was very little if any motion to the beams of light. * * * The time of greatest brilliancy was from 10:30 p. m. to 11 p. m., when wide beams of highly colored reddish and pinkish light extended from all quarters of the horizon to the zenith, giving the sky much the same appearance as the reflection from a large fire. At 1:30 a. m. the light had all faded out.

Grand Rapids, Mich. (90th meridian time), *March 7.*—A brilliant auroral display was observed on the 7th from 9 p. m. till near midnight. Red, pink, and green colors predominated, and the beams traveled rapidly in curtain-like waves from west to east and attained an altitude of 90°. Azimuth 135° to 225°.

Lansing, Mich. (90th meridian time), *March 7.*—An unusually brilliant aurora borealis occurred in the night of March 7, between 7:30 and 10:30 o'clock. The display began with luminous bands across the sky, from west to east. These increased in brilliancy and a faint reddish color began to be apparent, in a band extending upward from the western horizon, about half way to the zenith and about 10° in width. This band became more brightly colored, and others soon appeared. By 9 p. m. the entire sky, except a small arc near the southern horizon, was filled with luminous clouds, and by 9.30 p. m. these had taken on many brilliant colors, deep red predominating. The heavens seemed to be covered by a canopy of film in the form of bands and streamers, converging near the zenith, and variously and brilliantly colored. After 9:30 p. m. the coloring gradually faded and the bands and streamers slowly disappeared. The whole display was awe inspiring and many people were frightened by it.

Ludington, Mich. (90th meridian time), *March 7.*—A very remarkable aurora began at about 6:30 p. m., with a whitish arch in the north whose altitude of summit was 25° and azimuth of extremities 160° and 220°, and with whitish streamers reaching from near the horizon at places all along the north through the arch and up 60° or more. The streamers moved toward the west. Near each extremity and slightly above, was a patch of reddish light. The red increased and at 7:15 it was all along the arch. The arch in the north gradually rose and probably passed overhead; by 7:40 p. m. it was in the south, with altitude of summit 30° and azimuth of extremities 100° and 270°. By this time patches and streamers were over most of the sky. In the northeast and also in the northwest was a large patch of red. The arch continued in the south until about 9 p. m. and was whitish and 5° to 10° in width. At 8:55 p. m. there were great whitish sheets, mostly in the southeast. From about 8 p. m. to late in the night a crown or center was observed overhead and slightly southeast of the zenith. At 9:35 p. m. a great dome or canopy covered somewhat irregularly almost the whole sky. The crown was just southeast of the zenith, as stated above, and great sheets and streaks of white and red diverged in all directions. Reaching to 30° west of the zenith was a large area of flaming red. There was red also in the east but farther down in the sky. The display at this time was brilliant and impressive. Long streamers were present most of the evening and drifted toward the west. Practically no flashing was observed at any time. The display diminished after 10 p. m. and disappeared by about midnight.

Saginaw, Mich. (90th meridian time), *March 7.*—A magnificent display of aurora borealis was visible at 9:30 p. m. From a point of a few degrees south of the zenith, widening rays extended in all directions, reaching to the horizon on the east, west, and north, but being comparatively short toward the south. The rays were mostly of greenish tint, with some yellowish and purple, while broad bands or patches of blood red appeared in the east and west at about 45° elevation. Near the northern horizon the sky was a deep sea-green color. The display waxed and waned for a few minutes, but the red color had mostly disappeared by 9:50 p. m. while the green was also fading. Although the beauty of the color soon disappeared, rays of white or a very pale green continued to radiate from the focal point until after 10 p. m.

Citizens reported the aurora again visible between 1 and 3 a. m. on the 8th, but not so brilliant as on the previous evening.

La Crosse, Wis. (90th meridian time), *March 7–8.*—A brilliant display of aurora was observed on the 7th, and continuing into early a. m. of the 8th. Deep red and bright green colors were noted "for the first time in this vicinity."

**La Crosse, Wis.* (State Normal School), *March 7.*—On the evening of March 7 there occurred at La Crosse, Wis., the finest display of northern lights that the writer has ever seen here. There seems to be no record or remembrance of any equal display. The lights were observed more or less from 7:30 till 12 p. m. The best were seen from 9:45 to 10:45 p. m. During this time shafts of light starting from the horizon would shoot to the zenith. These shafts would be in the north, northeast, or northwest. After these started, others would follow them till three-fourths of the heavens were covered with these shafts of light, for they extended south of west and south of east. In the parts of the heavens

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farthest south the shafts of light were broken just below the zenith, but in the other parts of the heavens the shafts were continuous from the horizon to the zenith. The shafts did not flicker or flash as observed at other times, but remained stationary for a period and then died out.

The most remarkable thing was the colors exhibited. After the shafts had been established faint tinges of red appeared, which became brighter, till the heavens from the northwest to the northeast and for three-fourths of the way from the horizon to the zenith were covered with a bright crimson-red glow. The scene was magnificent and never to be forgotten.

The above light forms would stay for some minutes and then they would all die away and leave only a greenish hue in the north. In a few minutes more all would be repeated again. This repetition was noted several times in succession, till about 10:45 when it all faded into the greenish hue, which lasted an hour.

Other colors were observed as yellows and purples. These were seen as faint light toward the zenith, but the prominent color was the red, which with the definitely formed shafts gave a special character to these northern lights which will be easily remembered by the observers.—*C. H. Bretnall.*

Madison, Wis., March 7–8.—A remarkably brilliant aurora borealis [occurred] on the night of March 7–8, 1918. The illumination of the sky was noted as soon as twilight had passed away, and had not ended at half an hour after midnight. The most notable features were the brightness of the red green coloring, the extent of the illumination, which covered the entire sky, and the intensity of the earth-current disturbances attending the phenomenon. * * *

The illumination was brightest overhead, on account of the clearness of the sky there, but stripes and "clouds" were observed quite as far to the south as it was possible to make them out, certainly within 10° of the southern horizon.

The "radiant" of the auroral rays was about 5° south of the zenith, as judged by the eye.

The earth currents were especially strong at 7:12, 7:25, 7:31, 7:42, and 7:45 p. m., 90 meridian time. At these times they were strong enough to "arc" across the operator's keys and put a stop to telegraphic communication.—*E. R. Miller.*

Charles City, Iowa (90th meridian time), *March 7.*—Aurora was first observed at 6:40 p. m. There was then a dimly defined dark arch, the ends on horizon at 130° and 290° azimuth, the apex about 45° altitude; 40° to 45° of the sky above the arch was suffused in white, green, and yellow, while from the western end of the arch a slender rose-colored plume rose to within 10° of the zenith. It was the brilliancy of this streamer that first attracted attention to the display. At 7:15 p. m. the arch was plain, and from it extended upward quivering rose and white streamers, those from the center reaching the zenith. Between the white and rose there were broad bands of green with narrow yellow and violet edges. This formation soon broke into blotches or fields of white or rose on a green background. At one time the entire Great Dipper was enveloped in rose, the stars shining through it with undiminished brightness, with shafts of white separated by streaks of violet and yellow standing out southward, apparently horizontal. At 9:58 p. m. the arch was low on the horizon and dim, above it to zenith were broad, pale, white, green, and yellow streaks. Suddenly the base of energy shifted from the arch to overhead. Immediately around zenith lumps of white formed around a circle of blue sky some 10° radius, and having a bright star in its center. From this whitish ring streamers shot outward and downward in all directions, those to between 130° and 270° azimuth connecting with the arch, those to the southward ending when about 45° above the horizon. The streamers were of rose, violet, gray, and yellow, and stood out under a green sky filled with twinkling stars. One striking feature of the display was that no matter how deep or brilliant the intervening colors were the stars shone through undimmed. This formation remained intact for several minutes, then broke into groups of coloring which gradually faded. The display ended about 11 p. m.

Dubuque, Iowa (90th meridian time), *March 7.*—The aurora borealis on the evening of the 7th was one of the finest ever observed at Dubuque, even surpassing in grandeur the wonderful aurora of August 26, 1916.

The aurora was first observed at 7:15 p. m., consisting at that hour of a broad glow or band of light extending across the northern sky from northeast to northwest and high in the heavens. The aurora increased in brilliancy as the evening progressed, and was at its best between 9 and 10 p. m. At 9:30 p. m. the entire sky (except close to the horizon) was filled with quivering streamers or waves of light, converging overhead at a central point about 5° to 10° south of the zenith. The streamers were well defined, as though coming from searchlights.

The most distinctive feature of the aurora was the colors, green and red predominating. At 9:45 p. m. the greater portion of the northwestern sky was a brilliant red, which changed to greenish by 10 o'clock. At 10 o'clock a bright red streamer came out of the east (slightly north of east) and in a few minutes broadened out toward the north, and by 10:15 covered the greater portion of the northeastern sky. By 10:30 p. m. the northwestern sky had changed to greenish, and red appeared again in the northwest and overhead, but not so vivid as before. Perhaps the best description that can be given of the colors is that large bands or patches of red and green moved about over the northern half of the sky for nearly two hours.

Another prominent feature of the aurora was the many distinct patches or groups of light, resembling thin whitish clouds. They were numerous overhead and looked like cirro-stratus clouds of irregular shape. There was a decided contrast between the clear sky and the cloudlike patches. Where there were no patches the stars shown with much brilliancy, but through the cloudlike patches the stars shone only faintly.

A Dubuquer who spent his early life in Norway said of this aurora: "It was the finest I have ever seen in America, and resembled the wonderful auroras I used to see in Norway, except that the arch in the north was inconspicuous."

Sheridan, Wyo. (105th meridian time), *March 7.*—Brilliant aurora borealis observed early on the evening of the 7th. The first observation was at 7:40 p. m. local time, in the northwest where a fire-red sheet about 5° wide extended upward to 45° or 50° altitude. This was followed in a few minutes by a shaft of white not so broad, but reaching a higher altitude and located near a point nearly due west. Shortly after the display of red ceased in the northwest the eastern sky became red, the depth of color varying from minute to minute. At times half of the northeastern sky was red, the appearance at times being that of reflections from a huge fire on the earth. But the shifting of the sheet, its advance and retreats with the appearance of streamers of white within the red and at the border, gave proof of auroral display. At 8 p. m. a shaft of white 15° to 20° long and about 5° wide, was visible for a few minutes due east. Then the red with streamers shooting upward near to the zenith appeared across the most of the northern sky. No observations were made later than 9:15 p. m., but observers on the mountains report displays up to midnight.

Crow Hill, Wyo.—A few minutes past 7 p. m. a wierd-unearthly light appeared over the entire heavens, illuminating the evening sky; simultaneously shafts of lights began to display to within 20° of zenith, over the entire space between northwest and northeast. The display was a deep red. The line of coloring was very marked and did not merge with the other light at all. The auroral clouds moved very rapidly toward the northwest. At 7:30 p. m. the clouds diffused into continuous light, covering the entire sky, except a semicircle about 45° diameter in the south at the horizon. This continued till 8 p. m. when the red light suddenly changed into ordinary light, and the display began to wane. At 8:45 p. m. the display shifted to a position, from northeast to about 10° north of east, and the south half of the illumination was red. The illumination varied in intensity till 9:30 p. m. when I retired.—*C. A. Hurlbutt.*

Huron, S. Dak. (90th meridian time), *March 7.*—A brilliant auroral display was observed during the evening of March 7. Soon after sunset, and while the sky was still quite light in the west, it was observed that the light was not fading naturally from the eastern sky, but that there was a flare of whitish light extending up toward the zenith from a position a few degrees above the horizon a little south of due east. Soon after, a red arc of light began to appear extending up from a little south of the northwestern horizon and reaching almost to the zenith. This western red arc was at first narrow, less than a degree, and consisted of bands of dull-brick red light which at first lay quite parallel with the arc but later, 7:45 p. m., when a complete arc was formed with an apex in a crown of whitish light a degree or so south of the zenith, these red bands, which were more or less parallel, veered so as to cross the arc at an angle of about 45° extending from north to south. At 7:45 the arc was complete; the western portion being narrow, more or less well defined, and crossed by brick-red bands of light; the eastern portion being broader and composed of white light that ballooned out toward the south several degrees in places; the crown being a patch of white light a little south of the zenith, where the east and west arcs joined. The sky to the south of the arc for several degrees appeared covered with a thin high cloud that was lit up in an irregular manner and reflected light from the arc; stars were visible through this, but only the brighter stars were visible through the arc itself. The landscape was lighted with a dull reflection as from a distant fire. The north edge of the arc was quite well defined and the sky beyond dark and clear of clouds; the stars of the great dipper showed brilliantly, a bright star in the east, probably a planet, was also in this dark area. At 7:55 p. m. several sharp narrow bands appeared radiating from the north in the dark portion of the sky west of the great dipper; by 8 p. m. they had faded away. From 7:55 p. m. to 8:12 p. m. the whole arc increased in brightness, and the eastern half took on more of the appearance of the western half. At 8:03 p. m. a curtain of light appeared to radiate from the crown of the arc slowly to the northward, reaching the nearer stars of the great dipper at 8:12 p. m. Looking up at the crown of the arc the impression was that a curtain of light was unfolding and dropping from a great distance toward the observer. From 8:12 to 8:15 the light diminished; from 8:15 to 8:20 it increased again somewhat, and remained about the same until the whole phenomena was obscured by clouds that moved in from the northwest about 8:45 p. m. Later, about

10 p. m., it was noticed that the northern sky had a lumpy red appearance as though red light were being reflected from strato-cumulus clouds.

Rapid City, S. Dak., March 7.—An auroral display of unusual brilliancy and beauty was observed on the 7th. It was first seen at 7:20 p. m. (local time) and appeared in the west as a red light that resembled a large fire. Azimuth 80° to 130°. This light shown red to an altitude of approximately 40°. At about 8 p. m. the light in the west grew dim and an exceptionally fine exhibition appeared in the north, beginning at 130° azimuth and extending to 220°. This display presented the usual streamers shooting upward from the horizon, which ranged in altitude from 45° at the ends to 60° in the center. No bands or well-defined arch were seen. The light was red near the horizon and the streamers presented a reddish-yellow appearance. The phenomenon disappeared at about 10 p. m.

42½° to 40° N. lat.—The 34 reports from this belt indicate that, for part of the display, it was south of the zone of maximum, for most of the display was in the northern half of the sky, although at some places the southern auroral arch reached down more than half way from the zenith to the southern horizon. The intensity of the light is described as nearly equal to that of the full moon; and the colors were various shades of red, white, greens, yellows, blue, purples, and even orange—all together, the essential prismatic colors. The brilliant streamers flamed, pulsated, flickered or waved for brief periods, at least, at most places. The aurora was seen first at dusk, and last, at some stations in the early hours of the following morning. Wire communication difficulties were mentioned locally.

*New Bedford, Mass.**—At 10:30, when the activity was at its height, the entire northern sky was ablaze with greenish white light with countless streamers continuously darting up toward the zenith, the light being almost as bright as moonlight. * * * The entire heavens, with the exception of a space of about 30° from the southern horizon, was covered with a luminous cloud-like formation very similar to the familiar "mare's tails" except that they were constantly changing form, appearing and disappearing, streaks from north, south, east, and west converging in one small spot a little south of the zenith in the constellation Leo, just east of the Sickle. Very gradually, while all this was at its height, a faint orange red (in some places pinkish) glow appeared, arching the entire heavens from east to west. This glow slowly deepened in color, advancing from light red successively through vermilion and crimson of different intensity in different parts of the sky, until it vanished in about half an hour's time as a very deep purple barely distinguishable from the ordinary color of the night sky. All through this beautiful glow the greenish light constantly waved and shimmered like a silk flag blown out by the breeze. The peculiar part of the display was that at the north, where the greenish light was the most vivid, there was not the faintest trace of the red glow, that not commencing until an altitude of 60° or more was reached, while it descended all the way to the horizon in the east and west.—*Vincent Francis.*

Harrisburg, Pa. (75th meridian time), *March 7.*—At about 7:30 p. m. there appeared slightly east of north a very luminous, whitish segment extending from the horizon to about 30° altitude. In form it resembled a sunrise, but the brighter illumination appeared at the outer edge of the arc rather than at the apparent center of the segment. At 7:45 p. m. around the illuminated segment there appeared beams of light apparently emanating from the outer edge at an altitudinal angle of about 60°. These beams of light traveled in an east-wester direction, vanishing in the west. The beams of light were followed by red shoots or rays, which also traveled in an east-west direction. These red rays variegated into the prismatic colors for a few seconds and then blended into red. The red rays continued until about 8:10 p. m., after which there remained a whitish arc which rose gradually until it reached the zenith at about 11 p. m., being much fainter in illumination but still retaining the greater brilliancy around the outer edge. The rays or shoots were of uniform brightness over their whole length. At about 9 p. m. there appeared an aurora cloud extending in a southeasterly direction. The optical phenomenon was the most vivid observed in this locality for years. The delicacy of its beauty was more appreciable in the suburbs, as the city lights obscured the display from the observational tower.

Reading, Pa. (75th meridian time), *March 7.*—From 7:30 p. m. to 11:45 p. m. an aurora was observed. The sky was nearly covered with low clouds during the early evening until 9:30 p. m., but a faint red tinge could be plainly seen. After the sky cleared at 9:30 p. m. a red and at times yellowish tinges were observed, and were pronounced at several portions of the sky. Vibrating here and there in the northern portion of the sky a few quivering white streamers were seen which extended from the arch to close to the zenith.

* *Lafayette, Ind.*—On the evening of Thursday, March 7, a remarkable auroral display was visible here. Some observers report a faint red glow in the eastern sky as early as 7 o'clock, and it would appear from the testimony of several observers that the phenomena increased in brilliancy until about 9:45, at which time it was particularly striking. From the extreme northwest a broad band of deep red, like a cloud reflection of a conflagration, spread upward just south of the zenith, where it terminated within a horseshoe-shaped mass of white having the convex side toward the north. A similar but less brilliant red cloud extended from this point toward the east. Culminating at the same point within the horseshoe were greenish-white streamers extending in all directions to the horizon. At this time also there was another red patch covering somewhat more than the area of the Great Bear in the northeast. Athwart this ran the zenith streamers from the northern horizon.

At 10:45 p. m. the overhead display was fading and a broad red patch in the northwest covered Cassiopeia. This rapidly divided into two parts, drifting west and south.

By 10:30 the effect had practically disappeared except for a greenish glow toward the north.

Although the deep red color was massed in the streamers and patches mentioned, the entire sky was tinged with red, shading gradually outward from these dense masses.—*C. M. Smith, Purdue University.*

Notre Dame, Ind., March 7.—An exceptionally brilliant aurora occurred on the evening of March 7. It possessed features that had not been observed in auroras seen here in the past. It began about 7:30 p. m. At first shafts of white light were seen in the north. These extended upward over 90°. Later they were seen in the east and west and some in the south. Many of these met at a point a degree or two south and west of the zenith, forming a distinct focal point. The glow in the sky was brilliant and was of different colors—white, greenish-white, and red. This glow covered the sky with the exception of a portion of the south extending from the horizon upward about 45°. Two points were observed where the glow persisted, one in the middle of the eastern sky and the other about the middle of the southern. The aurora had about completely disappeared at 11 p. m.—*T. P. Irving.*

Valparaiso, Ind.—On March 7 there occurred a remarkable display of the aurora. Beginning about 7 p. m. as a pink-yellow glow and rising toward the zenith, by 7:30 it had developed the arch and was about 60° above the horizon. At 7:30 three areas of white light had formed, one in the southwest, one just east of south, and one in the southeast. The middle one was very vivid. At about 7:20 to 7:35 p. m. rather faint streamers of light resembling searchlight beams formed in the west between these areas and the main arch, and passed across to the east, occupying about 5 to 7 minutes in the passage. The main arch rose steadily, reaching the maximum at about 9 p. m., when it was about 20° south of the zenith. At 9:30 the arch had begun to recede and the three white areas began to fade. About 10 p. m. the color of the arch began to change to white, appearing first in the west. Numerous white streamers appeared from time to time radiating from the center of the arch. When last observed at 11:10 p. m. the arch had receded to about 25° above the northern horizon and was very faint.—*J. F. Bradley.*

Peoria, Ill. (90th meridian time), *March 7.*—The auroral display on the night of the 7th was probably the most brilliant seen in this section in many years. It began shortly after 7 p. m. and continued with varying but pronounced brightness till after 10 p. m., and with diminishing or faint illumination until after midnight. A considerable variety of forms appeared at different times, including a diffuse ill-defined glow, the arch, streamers, and irregular "clouds" of light. The colors seen were white, pink, a tinge of green, and orange; the effect was the most beautiful in the memory of many. All forms of display had a westward drift, but this was slower than the average observed here by the writer. The southward progression extended farther than usual. The colors apparently had a southward shift, from a point near azimuth 190° toward the zenith. The pink at times deepened to a pronounced orange. The uncolored "clouds" of whitish light were, at times, fully as distinct and prominent as are small patches of dense Ci. St. on a clear day; though at the same time stars shone through them with scarcely dimmed light.

The arch formation had its lower edge about 20° above the horizon, with the usual dark band below, and extended to about altitude 50° at the crown, and from about azimuth 130° to 230°. Later the arch was succeeded by somewhat irregular clouds of light. The southward advance of these carried their front fully 30° south of the zenith about 9:30 p. m. By that time the formation had dwindled to detached masses. The most notable display seen by the writer was at 9:35, when streamers or pillars of light on all sides were focused at the zenith, with a broad area of pink glow to northwestward which deepened to orange at about altitude 40°, azimuth 130°; the entire north at the same time being covered with irregular glow or patches of whitish light, with a flickering or dancing movement through it all.

* Reprinted from Popular Astronomy, No. 254, April, 1918, pp. 278-279.

* Reprinted from Science, Mar. 22, 1918, p. 291.

**Urbana, Ill.* (University of Illinois).—The most extensive and brilliant aurora witnessed in central Illinois within the memory of living men attracted unusual attention on the evening of March 7, 1918, at Urbana, Ill., in latitude 40° 6′ north, longitude 88° 13′ west. Although the aurora is only rarely visible here at all, this one reached beyond the zenith.

The aurora first attracted my attention at 9:25 p. m., central time, in the form of a band of white light about 2° wide, extending in an arc from a point on the horizon at about north 45° west across the north sky, reaching a maximum altitude of about 20°, approximately due north, and descending at about north 45° east. Through and beyond this, radiating white bands extending upward, and two rosy areas of about the color of the strontium flame appeared, one about north 45° east and 20° above the horizon, the other about north 10° west and 25° or 30° above the horizon.

The illuminated area extended rapidly, reaching a maximum at about 9:45 p. m., when it included the entire north half of the sky and overlapped into the south half from horizon to zenith. The main framework consisted of streamers of white light converging toward a point 30° or more south of and below the zenith. These streamers rose vertically from the north point of the horizon and its vicinity, but those rising from the east and west points of the horizon were inclined about 20° from the vertical (toward the south).

The streamers were fairly steady, in large part, extending, multiplying, and fading gradually; but in many parts of the sky there was a nearly continual play of light, in pulsations proceeding swiftly upward along the rays. Occasionally a streamer or a group of streamers brightened suddenly, giving an effect like that of the throwing on of a great searchlight.

Against the background of white streamers the red color expanded in glowing patches, increasing in brilliance as in area. During the maximum brilliance and extent of the aurora, the red was bright from the due east to the due west vertical circles and beyond them, and especially near the zenith (just below it to the north). It was never a continuous sheet of uniform brightness, but appeared brightest in roundish patches, locally streaking out parallel to the white streamers. The red lights pulsated and played up and down over the sky like the white.

About 9:50 p. m., after the aurora had faded slowly for a few minutes, the white streamers shortening to an altitude of 45° or less, the red light concentrated again in two patches, one about north 45° east and 20° above the horizon, the other north 5°–10° west and 25°–30° high. They varied from 3° to 10° or more in diameter. About 9:55 a third bright red area appeared, about north 40° west and 20°–25° above the horizon. It was less perfectly circular than the other two, having a tendency to show brightest and to expand along lines parallel to the white streamers.

About 10:05 p. m. the north 40° west and north 45° east red areas faded out, leaving a single glowing patch north-northwest 10° west and 20°–25° above the horizon, which continued to pulsate faintly and grow weaker. The white light had now subsided to a rather uniform sector of the north sky reaching from about north 50° west to about north 50° east and from the horizon to an arc whose maximum altitude lay in the site of the red patch in the north. At 10:45 p. m. there was still a glow in the north sky, apparent to an altitude of over 5°.

The angles here given were estimated, as I unfortunately had no instruments available at the time.—*C. W. Tomlinson.*

†Urbana, Ill. (University of Illinois Observatory).—Those who saw the aurora of August 26, 1916, did not expect to see such a display repeated within a lifetime, but on March 7, 1918, there was a similar spectacle which from reports must have been visible over practically all of the northern hemisphere of the earth. I first noticed the aurora low down in the north, about 7 p. m., but in half an hour clouds had come, which continued for an hour or so. At 9:30 I happened to be out of doors and saw that something startling was in prospect, as the sky was clear and the aurora was growing rapidly. The general effect and appearance of the display were accurately described by Dr. Tomlinson of our geology department [see above], and I shall limit my account to the determination of the position of the radiant or apparent focus of the auroral streamers. It was very striking that just when the display was at its maximum the streamers seemed to come from Saturn.

In the following notes central standard time, 6 hours slow of Greenwich is used, the position being latitude 40° 6′ north, longitude 88° 13′ west.

9h. 31m. Streamers rising. Cloud-like form in southeast.

9h. 36m. Radiant exactly at Saturn. Half of sky or more covered. To west and over Jupiter a broad band of red, 10° or 15° wide. This is southern edge of the aurora in that direction.

9h. 41m. Radiant 2° north of Saturn.

9h. 44m. Radiant 2° northeast of Saturn.

9h. 46m. Radiant fainter.

9h. 51m. Radiant has about disappeared.

9h. 51m. All of light is now below Polaris.

10h. 38m. Only faint glow low down.

No further display was noted by our observers at the telescope, who worked until several hours after midnight.

Averaging the three estimates, we have that at 9h. 40.3m. the radiant was 1.1° north and 0.5° east of Saturn. The magnetic elements for Urbana are: Declination 3° 13′ east, dip 71° 5′, determined by Mr. Merrymon in 1917, and kindly communicated by the superintendent of the United States Coast and Geodetic Survey. From the ephemeris position of Saturn, we readily find then for comparison:

	Declination.	Hour angle.
Magnetic zenith	+ 21.2°	+ 1.1°
Radiant	+ 20.1°	+ 0.2°
Difference	1.1°	0.9°

The result shows that within the error of estimate the apparent radiant or focus of the auroral streamers was at the magnetic zenith, which agrees with what was observed in 1916.—*Joel Stebbins.*

Davenport, Iowa.—The aurora was first observed at 6:50 p. m. low down on the northern horizon. At 7 p. m. its form was that of an arch crossing the northern horizon from east to west, with a maximum altitude of about 35° above the horizon. The color of the arch was greenish gray. Rose colored streamers crossed the arch radially at frequent intervals and faded quickly away.

The greenish arch rose higher in the sky shortly after it was first observed, and at 8 p. m. the highest point of the arc was about 70° above the horizon. By this time a second arc or band had also developed and extended as far south as the star Sirius. A dark space separated the two bands and the arches became broader and indistinct toward the east.

The maximum brilliancy of the aurora seems to have been reached at about 9:45 p. m. White streamers having the appearance of the most delicate cirrus clouds then extended from about 15° above the horizon, and from about 10° north of west to about 10° south of east, to a point about 5° south of the zenith, the general effect suggesting a gigantic canopy of some filmy material that had been drawn up and knotted loosely. This suggestion was heightened by a small, relatively dense area near the zenith, resembling a knot, beyond which the apparently loose end of the canopy extended a few degrees to the south. Beneath the base of the system of streamers the color of the sky varied from gray-blue to gray-green, the latter shade being almost identical with that frequently observed at the approach of dawn. Occasionally, two of the streamers, one about 20° west of north and the other about 30° east of north, became colored a rose shade, while the intervening space above the base of the streamers and to an altitude slightly above the Pole Star was suffused with a glow that suggested an enormous fire at a point some distance below the horizon. At such times the southern portion of the sky appeared intensely black to an elevation of more than 30°. Within a few minutes all traces of red or pink would fade out, leaving the streamers white, with the gray-green segment below and a peculiar misty effect close to the horizon similar to that produced early in the morning by a row of small trees set close together that are hardly discernible through a low fog. No trace of the usual dark segment could be observed at that time.

Shortly after 10 p. m. the streamers began to disappear and were wholly gone at 10:30 p. m. At 10:50 p. m. no trace of pink was any longer visible, although the faint green light could still be seen. The latter was last observed at 11 p. m.—*J. M. Sherier.*

Des Moines, Iowa (90th meridian time), *March 7.*—Beginning about 7:20 p. m., the aurora borealis became noticeable in the form of an arch of light in the northern sky at an altitude of about 25°. This rapidly enlarged, became brighter, and rose to an altitude of 60° by 8 p. m., the width of the arch being about 20° and extending from the eastern to the western horizon. About this time the flickering streamers of light known as "merry dancers" began to appear; also vivid colors, of which green predominated in the north and northeast and crimson in the northwest. About 9 p. m. broad bands of inky black, seemingly pivoted near the northern horizon, would appear in the east and rotate toward the west. A few minutes later large areas of light appeared in the south and gradually formed an arch of light at an altitude of about 30°. At 9:30 p. m. the entire heavens were ablaze with hues and shafts of light that rapidly changed into forms of endless variety, the predominating thing being shafts of whiter light that rose from the horizon at nearly all points, except a small arc in the south, and converged at a point a little—possibly 10°—southwest of the zenith. About 10:30 p. m. the display began to diminish, but some signs of it remained as late as 1:30 a. m. of the 8th. At times the light of the aurora was nearly equal to that of the full moon. This is probably the most brilliant display observed in this vicinity in many years. Telegraph service was much troubled by the magnetic effects of the aurora.

North Platte, Nebr. (90th meridian time), *March 7.*—An aurora borealis of unusual brilliance was observed from 8 p. m. of the 7th to after 12 midnight. The aurora consisted of a dark segment about 5° in width, above which was a whitish light, approaching at times a pale green, of

* From Science, Mar. 22, 1918, p. 291.
† Reprinted from Science, Mar. 29, 1918, p. 314.

about 19° or 20° in width. Above the white was a pink light, changing at intervals from a beautiful light pink to almost a red, this band being about 26° in altitude. At times narrow streamers of white light would shoot from the horizon to the zenith. The aurora was from 52° to 55° in altitude at its highest point; azimuth 120° to 250°.

Omaha, Nebr. (90th meridian time), *March 7–8.*—The most brilliant auroral display observed in years in this section began about 7:30 p. m. on the 7th and continued until about 2 a. m. on the 8th. When first observed the arch extended from about 100° to 265° azimuth and the center reached an altitude of about 42°, but constantly shifting streamers of light with well defined colors many times extended past the zenith. Reds, varying from dull copper to deep crimson tones, appeared at the extremities of the arch while blues, greens, purples and yellows predominated in the remainder. During the earlier part of the display parallel bands or rolls of light moved from the northwest across the sky to some distance beyond the zenith, and so bright were these that at times they blotted out the stars. By midnight the display had diminished to a pale green arch about 30° in height with considerable azimuth, but between 1:30 and 2 a. m. of the 8th brilliant streamers were again observed.

* *Peru, Nebr.*—We were favored here on the evening of March 7 by a magnificent display of aurora borealis. As soon as it was dark enough to see it, a great arch of pearly light appeared spanning the northern horizon, the center seeming to be a few degrees to the east of north. Here and there the arch would thicken and swell up like a great wave of light, from the crest of which streamers of greenish white, lavender, and red would shoot up, reaching and even passing the zenith at times. As a climax these streamers would fuse into another arch which would drift southward and dissolve, leaving usually a cloudy mass of greenish white or rose red light at the northeastern and northwestern ends of the new arch. This phenomenon was repeated many times, until finally the new arch passed the zenith and reached as far south as the belt of Orion, almost coinciding with the equator. The most wonderful displays came from 9:30 to 10 o'clock when the colors ranged from pearly white to greenish yellow, lavender, rose red, crimson, and cerise, until the whole northern half of the sky was lurid with variegated flames. The great constellations Leo, Orion, Taurus, Auriga, Cassiopeia and Ursa Major were swamped but not annihilated by the georgeous hues. Jupiter, Saturn, and Mars did not swerve a hair's breadth because of the threatening flames, though many people were frightened by the fiery glare of the latter through the crimson light, and were convinced that it had erratic movements. At the climax, two great streamers of pearly white light, much like gigantic comets, appeared in the northeast and northwest, reaching two-thirds the distance to the zenith. After 10 o'clock the exhibition gradually waned, until it was hidden by clouds about half past twelve.—*W. F. Hoyt.*

40° to 37½° N. lat.—Twenty-six reports were received from this belt. Where the aurora was most fully observed, it extended to 20° or more south of the zenith, even 45° and 60° S. being reported in Ohio. The display was brilliant, with shades of red, white, yellows and greens predominating, and with some purples. Tremulous, quivering, or pulsating streamers were reported generally, and one observer described the motion as "waving like electric fountains." The aurora began at dusk and lasted generally till about midnight, though some stations reported the aurora some time after midnight. Telegraph and telephone difficulties were reported: at Springfield, Ill., north-south lines were affected, while at Kansas City, Mo., only the east-west lines were influenced.

Springfield, Ill.—An auroral display, probably the most brilliant ever witnessed in this part of the country, was observed from 6:48 p. m. of March 7 to about 10:40 p. m. The phenomenon consisted, at first, of a perfectly formed arch of pale green light stretching across the northern sky from horizon to horizon. This band was about 15° wide. About 7:30 two spots appeared simultaneously at either end of the arch, extending upward in pulsating streamers of light until a secondary arch or semicircle was transcribed across the sky. This arch moved slowly southward, its crown eventually passing through and slightly beyond the zenith, where it rested for some time. The extremities of the upper arch remained at the east and west horizons long after the crown of the arch had disappeared, and these two sections became quite luminous at intervals during the continuance of the display. In the primary arch the altitude of the crown was 35° and the azimuth 195°; the azimuth of the western extremity was 130° and of the eastern 260°. The crown of the secondary arch passed through the zenith to a point 80° above the south horizon; the azimuth of the western extremity was 105° and of the eastern 285°.

At intervals streamers of soft vibrating radiance, the hues ranging from deep rose to purple, yellow, white, and green, extended upward from the main arch in sunburst effect, and were most pronounced a little to the west of north. Fields of dull crimson came into view intermittently, the brightest glows appearing in the west about 9:50, in the east about 9:55, and in the north about 10 p. m. All of these roseate illuminations, which would subside every few minutes to again appear in increased brilliance, were confined to the region lying between the two arches. There remained but slight traces of the luminosity at 10:30, and it had entirely disappeared at 10:42 p. m. Telegraph wires running north and south were noticeably affected during the display, but not those running east and west. The wires would alternately go out of commission and then return to normal.—*H. Merrill Wills.*

Hannibal, Mo. (90th meridian time), *March 7.*—A very brilliant aurora was observed at night. It was seen by some people soon after dark, but by the observer was first seen at 7:25 p. m., when it consisted of an arch of diffuse white light extending from about east to west and the upper edge at the elevation of and near the north star. The center seemed to be slightly east of the north star. This arch continued visible until after 11 p. m. At 7:40 p. m. beams of wavy columns of white light began to form near the east and west ends of the arch and move toward the zenith. At 7:55 p. m. a beam, a little south of the zenith extended at least 35° in length toward the eastern horizon. At 8:08 p. m. these beams extended from east to west and formed another arch about 10° south of the zenith. This second arch did not last long, but the wavy beams continued until about 9:10 p. m. About 9:10 p. m. a thin veil of wavy red light spread southerly from the northern arch to what seemed to be 10° to 15° south of the zenith and continued waving back and forth until about 9:40 p. m. At about 10:10 p. m. columns of bright and somewhat colored light emanated from the northern arch and reached nearly to the zenith. It is not known just how long these continued, but the northern arch was still visible at 11 p. m.

Kansas City, Mo.—The display was first observed at 7:30 p. m. as a faint, pale arch. By 7:55 p. m. a second arch appeared, extending from northwest to northeast, the altitude of the lower arch being about 8° or 10° and of the upper one between 15° and 20°. Both gradually extended upward until at 8:50 p. m. the upper one was at the altitude of Polaris and was becoming very dim, except at each end, which kept bright until nearly 10 p. m. The coloring at first was yellowish green, with faint bands or streams of light passing from one arch to the other and soon disappearing.

After 9 p. m. the northern sky became pink and a little later red in large patches, apparently having a drifting motion toward the southeast. The glow was not steady, but diminishing and increasing at short intervals and separating into patches perhaps 15° to 20° apart. Large patches of the sky were very red at 9:45 p. m. and a beam of gray light extended from the north horizon to the zenith. There was a slight tremulous motion for a short time at 9:45 p. m. of greenish streamers separating red areas. The last visible was a reddish glow in the northeast at an altitude of 20 to 25°, which disappeared at 10:10 p. m.

The sky was perfectly clear during the display and no clouds followed.

East-west telegraph lines were affected quite sensibly, while north-south lines did not seem to be influenced. This statement was made by an Associated Press attaché.—*P. Connor.*

St. Louis, Mo.—A brilliant aurora was observed at this station on the evening of March 7, 1918. The first streaks were noticed shortly after 7 o'clock, they had the appearance of thin, whitish cloud. Shortly after this, as was reported by a number of persons, greenish streamers made their appearance. The writer first saw the phenomenon at 9:25, when whitish streaks were observed rapidly lengthening and mounting toward the prime vertical. As they shot upward they changed rapidly to pink. Very soon the streamers coalesced, forming patches of color. Throughout its duration the aurora drifted at a perceptible rate from east-northeast to west-southwest. As the fields of pink passed the meridian and entered upon the western part of the heavens they changed first to bright red and farther on to deep red. A patch of sky in the northeast also was deeply colored. At the time of most striking display, about 9:40, there was a white band, 3° or 4° in width, extending from near the western horizon, through and past the zenith; a similar ribbon extended from the eastern horizon toward the above-mentioned band, but the two did not meet. Attending a temporary fading of the pink in the northeast, there developed a crescent-shaped field of white, approximately 30° above the horizon, azimuth about 225°. It was about 30° in length and resembled a portion of cirro-stratus cloud, highly illuminated. The points of the crescent pointed toward the east. Other bright areas were also observed at a few points. Clouds were not observed, unless some of these white patches were such, brightened by the auroral beams.

The stars were obscured in many places by the white and red patches. The principal illumination ended about 9:50, though for some time thereafter isolated streamers were to be seen. At its maximum development the radiance did not extend beyond the prime vertical except throughout a limited area near the western horizon.—*H. Tullsen.*

Concordia, Kans. (90th meridian time), *March 7.*—An unusually brilliant exhibition of the aurora borealis occurred in this vicinity

* Reprinted from Popular Astronomy, No 251, Apr., 1918, p. 279.

to-night. The display was first observed at 7:45 p. m. It then consisted of a luminous whitish-yellow bow, with a dark segment hanging below; presenting the appearance of a dark-wood alter covered with a white velvet cushion. The bow, or arch, extended from azimuth 140° to 225°, having an altitude of about 15° at each end, and about 20° at its center. A brilliant, diffused light filled the northern and eastern sky during the display, which lasted until 11:10 p. m.

From 8:15 to 10:35 p. m. a thin, red, cloud-like, ragged veil was noted in the northeastern sky, extending from azimuth 195° to 220°, its altitude being about 35–45°. This cloud-like formation was very thin, stars behind it shining with uniminished intensity.

Four bands, or streamers, of pale yellow light, tinged with green, flaring from the arch to an altitude of about 60°, were observed from 8:20 to 11 p. m. These bands were each about 3° wide, with their centers at 162°, 175°, 185°, and 202° azimuth, and were sufficiently dense to dim materially the light of stars behind them.

Topeka, Kans. (90th meridian time), *March 7.*—An unusually fine display of the aurora borealis was observed from 7:15 p. m. to 10:30 p. m. on the 7th. The auroral arch was well defined, rising about 20° above the horizon at its highest point, which was slightly east of north. The upper edges of dark segment, which formed a part of the auroral arch, were a silvery white like a dark cloud illuminated by a moonrise behind. The finest display of streamers occurred at 7:15 p. m. when as many as 25 were counted at one time, reaching an elevation of 60° at the highest point. By 7:50 p. m. these streamers had diminished somewhat in brightness, but were still in evidence, with velvety reddish glow covering a patch about 20° square in the northwest sky. At times a part of the dark segment would become detached and move slowly toward the zenith, having a shape somewhat like a rainbow and being illuminated on its upper edge with a silvery whiteness. At about 9 p. m. a mass of detached auroral clouds shown with an unusually white light in the northeast.

By 10:30 p. m. the display had greatly subsided and practically all that was left was the dark segment, with its silvery illuminated arch in the north.

No trouble with telegraph or telephone service was reported locally on account of the display.—*S. D. Flora.*

Wichita, Kans. (90th meridian time), *March 7.*—An aurora was observed during the evening of the 7th from 7:40 p. m. until shortly after 10 p. m. During the earlier portion of this time, it extended as a bright white band of light arched across the northern sky from about azimuth 135° to about azimuth 245°, the top of the arch at times extending upward from 30 to 45°. A rose-colored tint was observed for a time in the aurora in the northeast, and white streamers of light were pulsating upward from the arch at different points. Toward the end of the period mentioned the aurora became less distinct, except that from about 9:35 p. m. to about 9:45 p. m. a brilliant display of rose-colored streamers occurred above the auroral band in the northeast and north.

Baltimore, Md. (75th meridian time), *March 7.*—A brilliant aurora observed from 7:45 p. m. to 11:30 p. m.

Washington, D. C. (75th meridian time), *March 7–8.*—The aurora borealis of the night of March 7–8 was first observed about 7:30 p. m., and at times was of unusual brilliance. It took the form of an arch of light in the north. At one time, about 10 p. m., three arches were observed, showing at intervals brilliant colors of red, purple, and gold. It disappeared about 2:30 a. m. of the 8th.

Lexington, Ky. (90th meridian time), *March 7.*—At 7:45 p. m. attention was called to the aurora, consisting of a dark segment of a circle, the center resting below the pole star, with three greenish bands. Concentric with this, each about 6° wide and separated from each other about 10°, the lower being below the pole star, and the others beyond, the outer reaching an altitude of about 60°, and cutting the horizon at azimuths 110° and 250°. The outmost band was at times only fragmentary with conical termini. Mars and the Pliades were both at one time within the limits of the outer band. This gradually faded away till by 8:30 p. m. no colors were visible.

At 9:30 p. m. another observation was made and an amazing spectacle was in progress. The forms had greatly changed. A dark band was barely visible in the north. At northwest and northeast points rosy streamers 20° to 25° in breadth with a darker intervening space centered at north, occupied the sky. The darker space was streaked with brilliant greenish flashes, all colors momentarily varying in height from 50° to 60° to bursts like electric fountains, almost meeting from all sides in the zenith. By 9:45 p. m. the brilliancy considerably diminished, yet visible from the immediate proximity of street arc lights. The northwestern and northeastern glows faded by 10 p. m., while in place of the greenish streaks in the north appeared a broad rosy glow, gradually diminishing and finally disappearing by 10:05 p. m.

No telegraph disturbances were noted, but clicking sounds were heard in telephones, and one party was unable to use a phone at 9:50 p. m.

Cincinnati, Ohio (90th meridian time), *March 7.*—On the evening of the 7th at 6:45 p. m. a dim glow of light was observed in the north and northwest, but did not show any form. By 7:05 p. m. a fairly well-defined aurora borealis extended along the northern horizon above a band of smoke and haze. At 7:08 p. m. a pale red glow appeared in the northeast, above the east end of the arch, which gradually increased in size and spread into the north, where faint streamers extended rapidly to 45° above the horizon. A second arch of pale gray light formed above the first with about 3° of dark sky between. After a few minutes the two merged together and by 7:20 p. m. the red glow had disappeared, but the arch continued in the north. At 7:55 a bright patch of light appeared in the northwest and rapidly extended eastward, resembling somewhat the broad beam of a powerful searchlight, and forming a complete arch, which disappeared in five minutes, first in the west and last in the east. The main arch in the north gradually increased in altitude until 8:15 p. m. the center was probably 30° or 35° above the horizon, at the whole northern half of the sky was irregularly illuminated with white or gray light. During the following hour several arches or fragmentary portions of arches formed across the sky. They were continually changing in form and distinctness and extended mostly from north of west to south of east. Some were nearly through the zenith and others were south of the zenith. At 8:20 p. m. portions of three arches were visible at altitudes of about 45°, 70°, and 90°, respectively, above the southern horizon. The middle one of these arches was remarkably bright and complete. A glow of pale pink light appeared in the northeast at 9:30 p. m. and increased rapidly in size, becoming a deep red. Streamers shot rapidly up and formed one after the other farther to the west, finally extending into the northwest. The streamers extending up from the horizon directly in the north, were visible 15° beyond the zenith. From 9:37 to 9:30 p. m. the whole northern half of the sky was covered with a brilliant mass of bright red streamers, interspersed at numerous places with patches of gray or white light and forming a gorgeous auroral display. After this time the light began to fade in all parts of the sky and by 10:15 p. m. the aurora had disappeared.

Dayton, Ohio (90th meridian time), *March 7.*—An unusual auroral display was observed on the 7th, beginning about 7 p. m. and continuing till near midnight. Early in the evening a band or arch of white light extended across the sky from east to west about 30° above the south horizon. At about 7:30 p. m. a second arch appeared at about 45° nearly parallel with the first, and the latter became greatly intensified and very bright. The 45°-arch disappeared after about 15 minutes and bright spots appeared in the eastern sky, with streamers reached to about 90°. At 8:45 there were streamers running across the sky from northwest to southeast and at 9:30 p. m. the display was of marked brilliancy with streamers from the north and the sky became rose red. The entire display began at azimuth 105° and ended about azimuth 290.°

Indianapolis, Ind. (90th meridian time), *March 7.*—Aurora first observed 7:40 p. m Appeared as a hazy band of light 10° to 15° wide, in the form of a flattened rainbow. The maximum point was 45° above the horizon in the north, and the two ends faded away in the northeast and northwest. At 8:15 the streamers extended from two points near the horizon, west of northwest, and east of northeast, respectively, upward and diverging. The condition was most distinct at 9:30 p. m. No trace of the aurora could be detected after 10:15 p. m. The telegraphic service was very poor during the period in which the aurora was visible. Variable earth currents were reported by the local operator. The currents were most noticeable west of Chicago and east of Pittsburgh.

37½° to 35° N. lat.—The 16 reports from this belt indicate that the aurora was confined to the northern sky, reaching, however, almost, if not quite, to the zenith. Even here, the aurora was very brilliant, and streamers were observed everywhere, although no quivering of the lights is mentioned. Reds predominated; yellows, greens, and white were reported generally, and at one place blue also. The aurora was first seen at dusk and lasted generally till 10 or 10:30 p. m. (90th meridian time). At Bentonville, Ark., however, the aurora was visible till about 2 a. m. the 8th. Telegraphic disturbances were reported at two places.

Lynchburg, Va. (75th meridian time), *March 7.*—An auroral display of unusual brilliancy occurred on the night of the 7th. At 8:15 p. m. when first observed it was of the arc form, extending east and west through about 50° and to an altitude of about 18°. The arc separated a bright silvery glow from the dark sky above it. Along the arc was a red fringe with patches of deep red. No streamers were then present. The intensity of illumination increased to its maximum at 10 p. m. and afterwards decreased until 11 p. m., when it had almost entirely disappeared.

Soon after 9 p. m. the rays gradually appeared, the arc became fainter, and finally the northern skies were filled with diffused light, chiefly red and yellow, and many rays some of which converged. One of the most striking features observed was a ray about 3° wide that came from a point due north and gradually rose to the zenith.

While the display was at its best the diffused light reached an azimuth east and west of 45° and altitude of 80° and at times 90°.

Raleigh, N. C. (75th meridian time), *March 7.*—An aurora was observed from 8:15 p. m. to 11:15 p. m. The only distinctive feature was the illumination of the northern sky line to a height of about 30°. The predominating colors were red with a slight tinge of green until about 9:45 p. m., after which green replaced the red, gradually becoming faint and disappearing.

Chattanooga, Tenn. (90th meridian time), *March 7.*—An aurora borealis was observed by a large number of citizens, from about 8:30 p. m. to 10 p. m. in the north, extending from about 20° west of north to 20° east of north, and the crest of the arc was about 25° above the horizon. The arc was of a pale yellowish red, tinged with green, resembling the reflection of a large fire. No streamers were noted. The telegraph wires were affected.

Nashville, Tenn. (90th meridian time), *March 7.*—On the 7th a pronounced display of the aurora borealis was observed from about 8 p. m. to about 10:30 p. m. In the early part of the display there were three distinct arcs or arches of yellowish green light (some described it as whitish) extending across the northern sky. The two lower arcs were almost continuous from east to west extremities, and at the center, or crown, reached a height of probably 30° above the horizon. The third or highest arc was visible only as two or more patches of bright glow to the right and left of the center, and if it had extended across the north the crown would probably have reached 40° above the horizon. The azimuth of the western extremity was about 110° and of the eastern about 280°. The center of the arches was from 5° to 10° east of Polaris. The bands extended almost as far east and west of Ursa Major and Cassiopeia, respectively, as these castellations are distant from Polaris. The display was continually undergoing changes in appearance. The yellowish or whitish arcs, which at first were more or less continuous, were later broken up by dark areas and appeared as patches of illumination, varying in size and intensity. Between 8:30 p. m. and 9 p. m. a very faint reddish glow appeared in the northwest, and by 9:45 p. m. this had assumed a brilliant hue enveloping practically the entire northern sky and extending easily to the zenith. This was spread out as an even sheet of red, although there appeared through it, especially in the northwest, shafts or streamers of red light brighter than the rest. Some persons reported streamers also of whitish light, but in the city the streamers did not appear strong or of much duration. For the first hour the appearance was somewhat of the eastern sky just before the break of day. At 10:10 p. m. no trace of the aurora was visible.

Springfield, Mo.—On the evening and night of March 7, 1918, the sky was clear at Springfield, Mo., and an aurora was distinctly visible from 6:40 p. m. to about 10:15 p. m.

At 6:40 p. m. it consisted of bars of light in the northern sky of varying degrees of luminosity, extending upward about 20° and showing distinct coloring, dull red in the northwest and a bluish tinge in the northeast. By 7:45 p. m. it was brighter and extended upward about 35° and seemed to consist of a primary bow rising almost due east and setting in the northwest.

At 9:25 p. m. there was a whitish arc about ½ a degree in width extending from the eastern horizon to the northwestern horizon, its altitude being about 15° at the highest point. Beginning at the east, white and rose-colored streamers or shafts extended upward from the arc and the same phenomena were forming toward the northwest. These streamers spread rapidly upward and outward within a few minutes time, reaching almost to the zenith, and coloring the northern sky above the arc a rosy red. At a point in the northeast (azimuth about 235°) and in the north (azimuth about 190°) the streamers grew longer and brighter than at the other points of the arc. A faint greenish-white light appeared beneath the arc extending downward almost to the horizon. The streamers were at their maximum height and luminosity at 9:30 p. m., but soon receded and at 9:45 p. m. appeared as a luminous cloud that gradually deepened into night at about 10:15 p. m.—*W. B. Hare, and W. W. Talbott.*

Oklahoma, Okla. (90th meridian time), *March 7.*—A brilliant aurora was observed on the night of the 7th from 9:40 p. m. to 10:20 p. m. When first noted it was merely a glow in the north, on what seemed to be a thin white cloud bank, running from north to northeast. The color, or light (a deep pink or rose) soon spread and covered a large strip of sky between the north and northeast and from 9:45 p. m. to 9:47 p. m. it seemed as though several powerful searchlights were trained upon the upper part of the cloud, or curtain of color. The beams, however, did not reach the zenith nor did the base of the "curtain" reach the horizon. The color, or light, drifted from the north to the northeast and disappeared at 10:20 p. m. Stars were plainly visible through the curtain. Many 'phone calls were received at this office regarding the display. Many were of the opinion the light was due to the reflection on the clouds of a large fire somewhere to the north of the station and the streamers due to a battery of searchlights playing upon it. The color during the greater portion of the display was vivid.

35° to 32½° N. lat.—The 5 reports from this belt indicate that the aurora extended only about half way to the zenith up from the northern horizon. Some streamers were seen, and at Fort Worth, Tex., "a pronounced vibrating motion was noticeable." Red was the only color reported. Except at Little Rock, Ark., where the aurora was seen as early as 7:30, the display was noticed only between 9 and 10 p. m. (90th meridian time), the time when it was most brilliant farther north.

Little Rock, Ark. (90th meridian time), *March 7.*—An auroral display was observed between 7:30 p. m. and 9:30 p. m. It had the appearance of a red tinted cloud in the heavens about 10° to 20° above the horizon. Streamers shot from the body of the display toward the zenith reaching an altitude of about 40° to 50°.

Dallas, Tex. (90th meridian time), *March 7.*—An aurora borealis, or northern light, was observed from 9:35 p. m. to about 10 p. m. The arch light was red and first observed to the north-northeast near the horizon and appeared to spread upward and westward until it extended from northwest to northeast and was visible over an area of altitude of about 10° to 45°. Band-like streamers were observed perpendicular to the arch.

Fort Worth, Tex., March 7.—"The aurora was noted between 9 and 10 p. m. local time. The color was generally deep red, and about halfway between horizon and zenith. The width subtended an angle about 8° to 10° and the length about 60°. A pronounced vibrating motion was noticeable. Domestic animals became frightened and showed uneasiness, dogs trying to get into the house and whining."

32½ to 30° N. lat.—The 6 reports from this belt show that the aurora was a rather bright red arch extending up to 30° above the northern horizon, seen from 9:15 to 10:30. At Taylor, Tex., however, the display was visible from about 7 p. m. to 1 a. m.

Vicksburg, Miss. (90th meridian time), *March 7.*—An aurora borealis was observed from 9:30 p. m. to 10:30 p. m. From the accounts of those who saw the phenomenon it appears that the aurora was visible in the north over an arc of about 60° to an altitude of about 30°, and it was of a reddish tint, at times rather bright.

Alpine, Tex. (Brewster County), *March 7.*—From about 9:30 p. m. to 10:30. Queer red reflection in northeast (resembling a large fire), flaring up for about 10 minutes near 10 o'clock; covered arc of 30°.

Taylor, Tex. (90th meridian time), *March 7.*—An aurora borealis was observed on the night of the 7th. It was seen in the north from about 7 p. m. to midnight. It had the appearance of a large and distant fire, having a yellowish hue. It extended about 22° above the horizon. Telephone reports from Austin and points in this vicinity gave information of the appearance of this phenomenon throughout this section.

30° to 27½° N. lat.—Five reports indicate that the character of the display was practically the same as in the next belt farther north. Even some streamers were seen at Winter Park, Fla. The display was observed generally from 9:15 to 10, although at Bartow, Fla., it lasted till 11 p. m. (90th meridian time). Long-distance telephone communications were difficult from Tampa, Fla.

Winter Park, Fla., March 7.—The aurora of March 7 was seen at Winter Park, Fla. (latitude about 28° 37′ N.). It was visible for a short time only between 9:30 and 10 p. m., Central Standard Time. Those who saw it described the sky as brilliantly red for perhaps 40° along the northern horizon, with streamers extending halfway to the zenith.—*Frank P. Whitman, in Science, April 19, 1918, page 393.*

27½° to 25° N. lat.—The 1 report from Miami, Fla., is self-descriptive.

Miami, Fla. (90th meridian time), *March 7.*—An aurora, the first of record at this station, occurred during the early part of the night of the 7th–8th, being observed by many persons between the hours of 9:15 p. m. and 10 p. m. Descriptions by several observers indicate that the phenomenon appeared as a brilliant illumination of the northern sky, the color being a dull red. The altitude of the crown above the north point of the horizon apparently was between 15° and 20°. The azimuth of the extremities is not known. No streamers or bands were observed.

WOLFER PROVISIONAL SUN-SPOT RELATIVE NUMBERS.*

The provisional relative sun-spot numbers given in Table 1 herewith are in continuation of the observed relative and the smoothed relative sun-spot numbers published in the REVIEW for July, 1915, **43**: 314.

While these provisional numbers are subject to slight revision, and later will be smoothed by the method described in the REVIEW for April, 1902, **30**: 171, they are sufficiently accurate to show that at the crest of the maximum of 1917 the relative sun-spot number was in excess of 100, which is unusually high.—*H. H. K.*

TABLE 1.—*Wolfer provisional sun-spot relative numbers, January 1915–December, 1918.*

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1915 [1]	25.7	35.6	34.9	42.2	35.0	69.9	71.0	68.8	44.7	53.5	38.2	32.7	46.0
1916 [2]	44.3	55.4	66.5	73.3	71.4	67.7	53.0	34.1	41.4	56.0	60.7	41.0	55.4
1917 [2]	76.2	71.8	86.6	63.7	112.7	113.8	117.0	143.2	121.9	71.4	90.1	116.8	98.8
1918 [3]	96.3	63.4	72.2	76.5	76.5	62.8	104.6	94.1	73.5	86.1	68.0	54.8	77.6

[1] Met. Zeit, 1915, **32**: 188, 364, 508, and 1916, **33**: 42.
[2] Terr. Mag. Sept., 1918, **23**: 136, **24**: 43, and others.
* Replacing data in this REVIEW, September and December, 1918, **46**: pp. 468 and 574.

Sun-spot numbers are determined by a somewhat arbitrary rule, but they are approximately proportioned to the spotted area of the sun. One hundred as a sun-spot number corresponds to about one five-hundredth of the sun's visible disk covered by spots.—*Met. Off. Circ., 23, Apr. 25, 1918.*

In reporting on the sun spots observed in the year 1918 Mr. Evershed, director of the Solar Physics Observatory, Kodaikanal, remarks that the maximum spot activity of the present cycle took place during the second half of 1917 for both hemispheres. This judgment may be accepted as correct, for though some hesitation has been felt in accepting this early date lest a secondary maximum should occur after a temporary decline, as has happened in previous cycles, these circumstances do not seem likely to occur. The date of the previous maximum has been placed in the early part of the year 1906, though the sun-spot activity of that year was inferior to that of 1905 and of 1907. Adopting these estimates as correct, the length of the period just ended is slightly above the average.—*Nature (London), June 12, 1919. p. 291.*

THE WEATHER DATA NEEDED BY ECLIPSE EXPEDITIONS.

In spite of the fact that some of the observing stations for the total eclipse of May 29, 1919, were in the equatorial rain belt, satisfactory results have been obtained.

"In connection with the coming solar eclipse of September 10, 1925, the path of totality of which crosses Mexico, Prof. W. W. Campbell renews a suggestion which has been made by Prof. Todd and other astronomers, viz, that weather observations should be made along the prospective shadow path for a few years before a total eclipse, not only at the season of the year in which the eclipse is to occur, but also at the hour of the eclipse. The observations made at the regular term-hours at meteorological stations often give an entirely erroneous idea of the kind of weather likely to be encountered at the time of an eclipse. Prof. Campbell says that the data supplied to prospective observers of the Russian eclipse of August 21, 1914, were based on observations made in the morning and evening, and gave fair promise of clear skies for the event. After the eclipse parties reached Russia they were surprised to discover that while clear weather was the rule in the evenings and mornings and at night, cloudiness generally prevailed in the middle of the day, reaching its maximum at about the eclipse hour. The Lick Observatory would not have sent an eclipse expedition to Russia if this condition had been known. * * *"—*Sci. Amer., New York, June 21, 1919, vol. cxx*, p. 649.

LAND AND SEA BREEZES IN THE VICINITY OF CORPUS CHRISTI BAY, TEX.*

By C. E. HECKATHORN, Observer.

[Dated: Weather Bureau, Corpus Christi, Tex., May 17, 1919.]

SYNOPSIS.

Corpus Christi Bay is almost a land-locked body of water, 20 miles wide from east to west and 16 miles from north to south and 14 feet deep. The result of these physical factors is that Corpus Christi Bay is considerably warmer than the Gulf of Mexico, and, at night, very much warmer than the adjacent land areas. It is situated south of the paths of HIGHS and LOWS so that its temperature and winds are little affected thereby. With such striking differences in land, bay, and sea temperatures it follows that the land and sea breezes present an interesting study.—H. L.

Corpus Christi Bay is an almost land-locked body of water about 20 miles in length east and west by about 16 miles in width north and south and is far enough south (north latitude 27° 40′ to 27° 56′) so that the winds and temperatures of the vicinity are not dominated by areas of high and low pressure that cross the United States during the summer season (see fig. 1). It is separated from the Gulf of Mexico by Mustang Island, which is quite narrow and is one of the chain of narrow islands paralleling the Texas Coast. The bay has only two connections with the Gulf of Mexico, Corpus Christi Pass at the south and Aransas Pass at the north end of Mustang Island. Both passes are quite narrow and Corpus Christi Pass is shallow, having a depth of less than 3 feet; allowing only a very limited mixing of the water n the bay with the water in the gulf. Extending southward from the east end of the bay is a long narrow body of water, Laguna Madre, which has no other connection with the Gulf of Mexico except at its southern extremity, over one hundred miles south of Corpus Christi Bay. Laguna Madre is shallow, being less than 1 foot in depth in most places and only a few feet in depth in the deepest places. Extending northeastward from the northeastern extremity of Corpus Christi Bay is Shoal Bay; a body of water similar to Laguna Madre. The Nueces River enters the western extremity of Corpus Christi Bay through Nueces Bay, which is also shallow; permitting the water of the river to be affected by radiation so much before entering Corpus Christi Bay that it is near the temperature of the surrounding land when it enters Corpus Christi Bay. Corpus Christi Bay has an average depth of about 14 feet and is quite uniform in depth except near the shores.

In the summer season, owing to almost uninterrupted insolation, almost complete separation from the Gulf of Mexico, and the relatively high temperature of most of the water entering it, the water of Corpus Christi Bay becomes much warmer than the water in the Gulf of

* For other recent discussions of sea breezes locally on the coast of the United States see "Sea breeze on eastern Long Island," by E. S. Clowes, Monthly Weather Review, 1917, **45**: 345–346; and in "Certain characteristics of the winds at Mount Tamalpais, Calif," by H. H. Wright, ibid., 1916, **44**: 514.—EDITOR.